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The article in Vol. V, No. 2, of this JOURNAL concerning the experiments conducted under Prof. Jastrow's direction in reference to our estimation of verticals and angles, leads me to think that an observation of my own, which I have not seen recorded by any writer, may not be without interest to the readers of this JOURNAL.

Let the experimenter prepare a large sheet of paper thus: Set this in some convenient position, with its lower line horizontal against a dark background, the paper itself being well illuminated. The observer's eyes themselves should be screened from strong light. Let the observer lie down, resting on the left side, facing the paper, the plane of which must be about perpendicular to the line of vision.

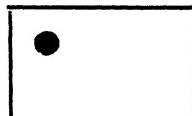


FIG. 1.

Let him gaze at the black spot steadily for as long as may be necessary to obtain a strong *after-image*. This will be *thought* as shown in Fig. 2.

Let the observer now, with eyes still closed, roll over to the right; he will find that he *thinks* the image turning on an axis in the same direction, and when he reaches a position in which he is lying on his back he will *think* the position of the image as seen in Fig. 3.

If he turns still further until he is lying upon his right side, having made a $\frac{1}{2}$ revolution, he will *think* the image as presented in Fig. 4, it having made only a $\frac{1}{4}$ revolution.



FIG. 2.



FIG. 3.



FIG. 4.

If he turn with face down he will *think* the image as seen in Fig. 5. If he turn one more quarter, one would suppose from what has preceded that he would *think* the image as shown in Fig. 6; but in fact somewhere between Figures 4 and 5 there is a change, and when he reaches the end of this last $\frac{1}{4}$ turn the image is *thought* as it was when he originally lay in this position on his left side. See Fig. 7.



FIG. 5.



FIG. 6.



FIG. 7.

This simple experiment seems to me to indicate that our judgments of verticality are determined largely by relation of our retinal images with the consensus of the feelings involved in balance or relation of our whole mass to the direction of the force

of gravity. How enormously complex must be the judgment-problems here involved, is apparent when we consider that each difference of position involves changes in some elements of the complex psychosis of balance.

I present this simple fact to the active workers in the field of experimental psychology, hoping that it may prove of service to those who are engaged in the study of these special phenomena.

HENRY RUTGERS MARSHALL.

Zur Physiologie und Pathologie der Handschrift. GOLDSCHNEIDER.
Archiv für Psychiatrie, XXIV, 1892, 503.

An important contribution to the theory of hand-movements. G. gives, first, a theoretical account of the origin of what the present writer has called "tracery-imitation," under the equivalent phrase, *malende reproduction*, *i. e.*, the association between visual pictures (letters, figures, etc.) and the hand-movements necessary to reproduce them (writing, drawing, etc.). He finds three "moments" in the rise of "tracery-imitation" (see his *résumé*, p. 587): A, an optical picture of the hand-movements (*optische Vorstellung der Handbewegung*) required for making the desired letter, derived from the child's earlier sight of his own hand-movements; B, a series of new motor discharges, strengthened by practice; C, a series of sensations of actual movement, by which the discharges are regulated and controlled. Moment A is clearly seen in the fact, often remarked, that in writing with the eyes closed we follow still a clear optical outline. In moment A there are two evident factors: (1), constant kinæsthetic memories (*Bilde*) from each position and each amount and direction of movement of the member, and (2) optical presentations of the same positions and movements (*optische intendirte Bewegungsbilde*). Moment C is for Goldschneider entirely kinæsthetic, as we would expect from his earlier papers.¹ He establishes, however, an entirely new element in this kinæsthetic complex in the case of writing, *i. e.*, a series of pressure sensations which vary with each character and each stroke. By a neat apparatus—consisting essentially of an air-cushion, upon which the pen-point of the subject rests, and a connected Marey tambour with graphic attachments—he demonstrates definite pressure curves for the different letters of the alphabet, punctuation marks, etc. [In the view of the present writer, this derivation of "tracery-imitation" is not adequate, simply for the reason that it assumes it. Given "moment" A—an association between definite hand-movements and the corresponding optical presentations of the same hand-movements—the latter might be sufficient, with practice, to innervate the former. But the question remains: How is this association established? How does the child come to connect the optical presentation of figure (*Gestalt*) with the optical hand-movement and kinæsthetic hand-movement series? G. does not recognize the fact that visual recognition of figure (pictures, letters, etc.) is definitely established long before the child is able or has any tendency to trace them.² He is wrong, accordingly, in identifying the optical figure series with the optical hand-movement series. An optical figure-series is really the first "moment" in the derivation of hand-writing—either a purely retinal series or an eye-movement series, according to the view adopted of the rise of visual perception of figure. The question then is: How does this optical figure-series come to stimulate the two muscular

¹ See *Untersuchungen über den Muskelsinn*, *Du Bois-Reymond's Archiv*, 1889.

² See my article in *Science*, XIX, 1892, p. 16.